providing a dielectric core;

helically winding a conductive wiring circumferentially around the dielectric core; and

cutting, normal to an axis of the dielectric core, through the conductive wiring and through the dielectric core, at two locations along the axis, leaving a conductive button between the two location as having a first end and a second end, wherein the conductive wiring terminates in at least two end contacts at the first end, and wherein the conductive wiring terminates in at least two end contacts at the second end.

The present invention reduces the probability of failure of the electrical coupling between two substrates of an electrical structure. Additionally, the present invention facilitates repairing or upgrading of the electrical structure.

Brief Description of the Drawings

FIG. 1 depicts a top view of a substrate with an array of conductive pads on a surface of the substrate, in accordance with the related art.

FIG. 2 depicts a cross-sectional view of an electrical structure comprising two substrates electrically and mechanically joined at corresponding conductive pads by a conductive button, in accordance with the related art.

FIG. 3 depicts a cross-sectional view of two substrates electrically and mechanically coupled at corresponding conductive pads by conductive buttons, in accordance with embodiments of the present invention.

FIG. 4 depicts a perspective view of a dielectric core, in accordance with embodiments of

the present invention.

FIG. 5 is depicts conductive wiring helically wound around the dielectric core of FIG. 4.

FIG. 6 depicts the helical wiring of FIG. 5 as braided.

FIG. 7 depicts the helical wiring of FIG. 5 as served.

FIG. 8 depicts an outer dielectric jacket extruded onto the helically wired dielectric core of FIG. 5, thus forming a conductive rod.

FIG. 9 depicts a cross-sectional view of the dielectric jacket extrusion process of FIG. 8.

FIG. 10 depicts the conductive rod of FIG 8 after being inserted into a dielectric place holder.

FIG. 11 depicts FIG. 10 after the conductive rod and similar conductive rods have been axially cut, leaving conductive buttons in the dielectric place holder.

FIG. 12 depicts a cross-sectional view of end contacts of a conductive button, said end contacts created by mechanical cutting of a conductive rod from which the conductive button was formed, in accordance with embodiments of the present invention.

FIG. 13 depicts FIG. 3 with conductive buttons being soldered to one of the two substrates, in accordance with embodiments of the present invention.

FIG. 14 depicts FIG. 13 after conductive buttons have been soldered to the other of the two substrates, in accordance with embodiments of the present invention.

Detailed Description of the Invention

FIG. 3 depicts a cross-sectional view of substrates **32** and **34** electrically and

mechanically joined at corresponding conductive pads **33** and **35**, respectively, by conductive buttons **38**, in accordance with embodiments of the present invention. The word, "conductive," (and variants thereof such as "conductively") herein means "electrically conductive" unless otherwise noted. The conductive pads **33** and the conductive pads **35** each constitute a two-dimensional array of electrically conductive pads (e.g., gold or gold-plated pads). The substrate **34** may include, *inter alia*, a printed wiring board (PWB). The substrate **32** may include, *inter alia*, an electronic module such as a chip carrier with one or more attached semiconductor chips.

The conductive button **38** electrically couples the substrate **32** at the pad **33** to the substrate **34** at the pad **35**. Each conductive button **38** comprises a dielectric core **40**, a conductive wiring **42** helically wound around the dielectric core **40**, and an outer dielectric jacket **44** around the conductive wiring **42**. The conductive wiring **42** terminates in the end contacts **47** at an end **41** of the button **38**, where the end contacts **47** mechanically and electrically contact the pad **35**. The conductive wiring **42** also terminates in the end contacts **48** at an end **43** of the button **38**, where the end contacts **48** mechanically and electrically contact the pad **33**. As a result, the substrate **32** is conductively coupled to the substrate **34** by the following conductive path: pad **33**, end contacts **48**, conductive wiring **42**, end contacts **47**, and pad **35**.

The aforementioned mechanically and electrically contacting of the end contacts **47** and **48** to the pads **35** and **33**, respectively, is accomplished by application of a compressive force **46** (e.g., clamping) on the electrical structure **30**. The compressive force **46** is transmitted to the pads **33** and **35** where the transmitted force on the pads **33** and **35** is directed toward the button **38**. A dielectric place holder **36** holds the buttons **38** in place. The dielectric place holder **36** is